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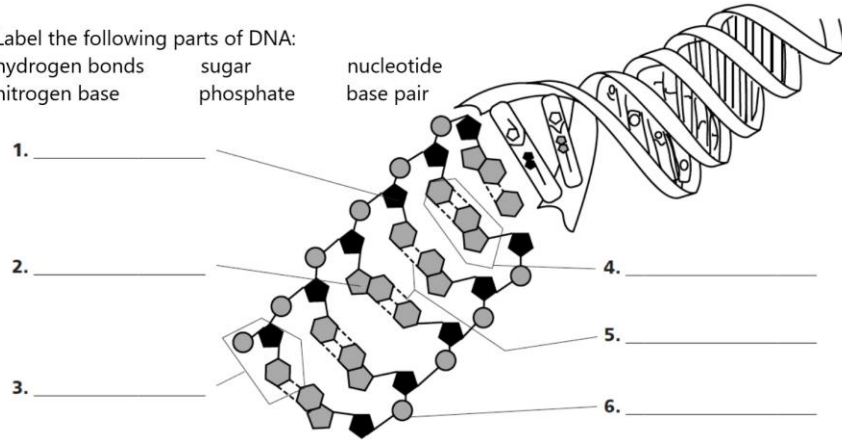
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Name _____ Date _____

DNA Structure & Replication

Label the following parts of DNA:

hydrogen bonds sugar nucleotide
nitrogen base phosphate base pair



7. What are the sides of the DNA composed of? _____
& _____
8. What are the "rungs" of the DNA "ladder" composed of?

9. What is the shape of DNA? _____
10. Write the complementary base sequence to the following sequence.
A T G A C C T G A

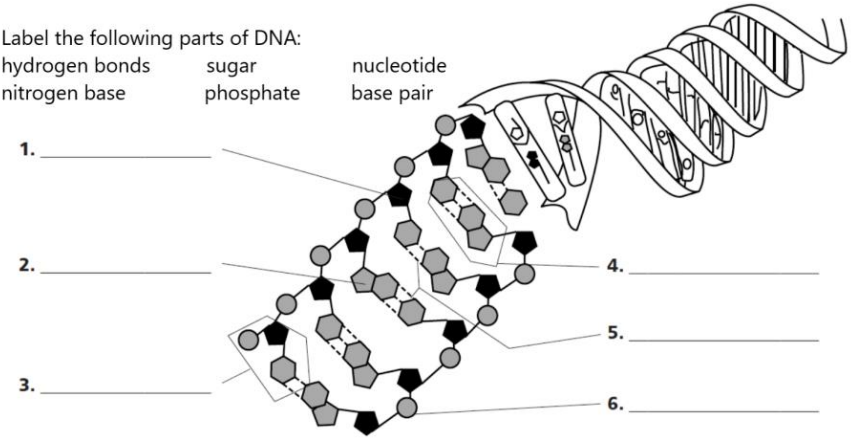
11. Place the events of DNA replication in order:
 - a. _____ DNA polymerase attaches to the primer
 - b. _____ Okazaki fragments are glued together by ligase
 - c. _____ DNA helicase breaks the hydrogen bonds and unwinds DNA
 - d. _____ DNA polymerase adds new nucleotides in a 5' to 3' direction
 - e. _____ Replication fork forms
12. Why does DNA replicate before a cell divides?
 - a. To ensure both cells are genetically different
 - b. To ensure both cells are genetically identical
 - c. To ensure each cell gets half the genetic information

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DNA Scientists

Match the following scientists to our understanding of DNA

- A. Erwin Chargaff
- B. Rosalind Franklin
- C. Maurice Wilkins
- D. Watson & Crick
- E. Oswald Avery
- F. Hershey & Chase

1. _____ Worked in x-ray crystallography; took Photo 51 of DNA
2. _____ Determined that the percentage of A always equaled that of T and the percentage of G was equaled to C
3. _____ First isolated DNA as the material of genes and chromosomes
4. _____ Also worked on taking pictures of DNA, shared Nobel Prize for discovery of structure
5. _____ Credited with discovering the structure of DNA
6. _____ Confirmed that DNA was the genetic material of life
7. In your opinion, which scientist had the greatest impact on our lives today. Explain your reasoning. _____

Name _____ Date _____

DNA Scientists

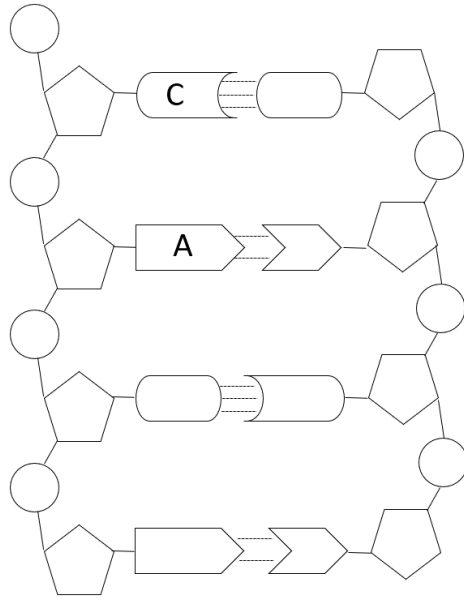
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Name _____ Date _____

DNA Structure



Complete each task using the diagram:

- Label all the sugar molecules with an S
- Label the phosphate molecules with a P
- Circle one nitrogen base
- Draw a square around 1 nucleotide
- Highlight the hydrogen bonds
- Label the nitrogen bases according to the base pair rule using the letters A, G, C, T

The strands are said to be **anti-parallel**, based on the picture, what does that mean? _____

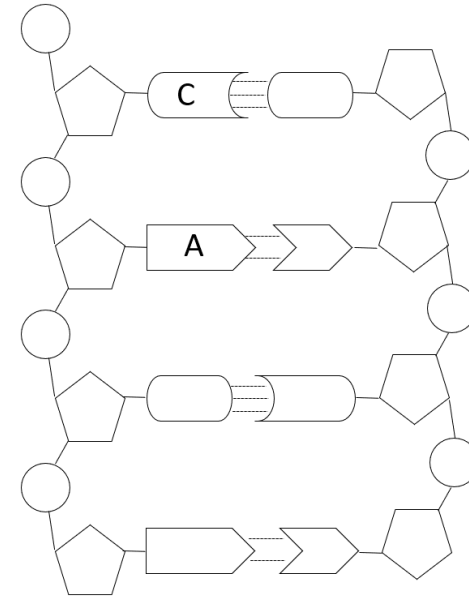
DNA is the hereditary information of organisms. What part of DNA determines the traits of an organism? _____

What do you think would happen if there was a small mistake in the DNA, maybe a base is paired wrong or missing? _____

DNA is the universal genetic code because _____

Name _____ Date _____

DNA Structure



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DNA Replication

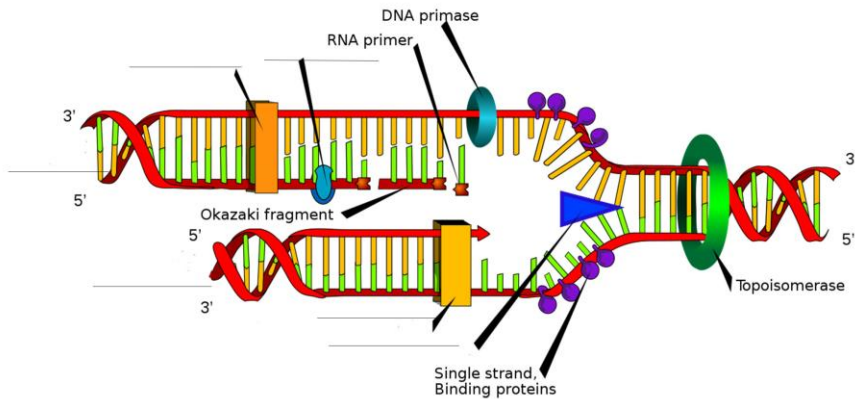
Explain what role each enzyme plays in DNA replication:

- DNA helicase: _____
- Ligase: _____
- DNA polymerase: _____

Place the events of DNA replication in order:

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Label the following on the diagram: DNA polymerase (x2), ligase, helicase, lagging strand, leading strand



Explain the difference between the lagging and leading strands. _____

Name _____ Date _____

DNA Replication

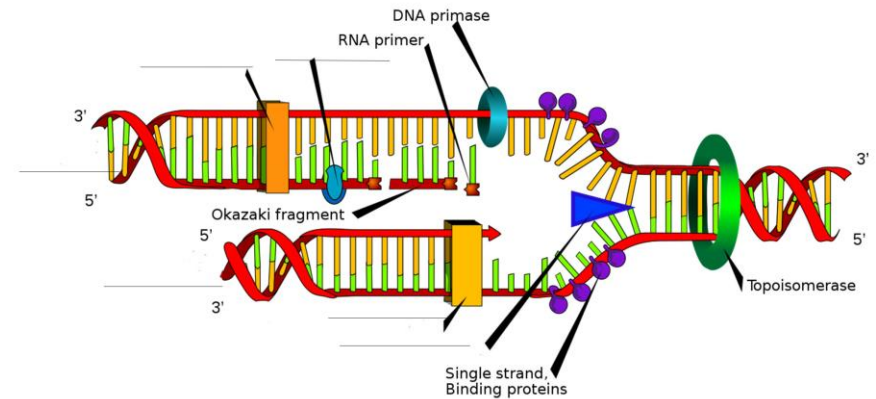
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Explain the difference between the lagging and leading strands. _____

Name _____ Date _____

Genetic Material

- Genetic Material is _____

Describe or sketch each of the following:

DNA

CHROMOSOME

GENE

Explain the connection between DNA, chromosome, and gene _____

Name _____ Date _____

Genetic Material

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Cell Cycle

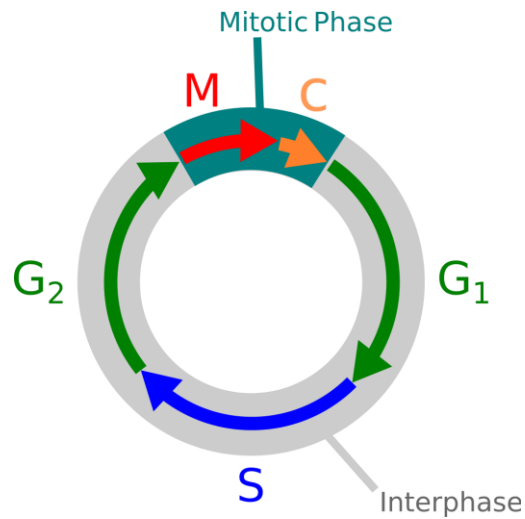


Figure 2: George Weller / CC BY-SA (<https://creativecommons.org/licenses/by-sa/3.0>)

Match the phase to the events of that phase.

- _____ Period of growth and development between mitotic divisions
- _____ DNA replication occurs
- _____ Cell grows to its full size
- _____ Nucleus divides to form two identical nuclei
- _____ Cell increases the amount of cytoplasm and copies organelles to prepare for division
- _____ Cell membrane pinches inward to split into two cells

- Why does the DNA replicate before the cell divides? _____

- What are two reasons cells go through mitosis? _____
& _____
- Why can't cells just get bigger and bigger and bigger? _____

- Some cells never go through mitosis again after being formed. What are some examples you can think of? _____

Name _____ Date _____

Cell Cycle

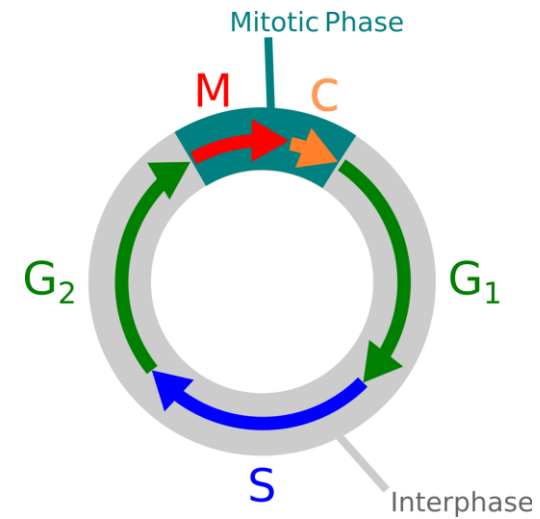


Figure 1: George Weller / CC BY-SA (<https://creativecommons.org/licenses/by-sa/3.0>)

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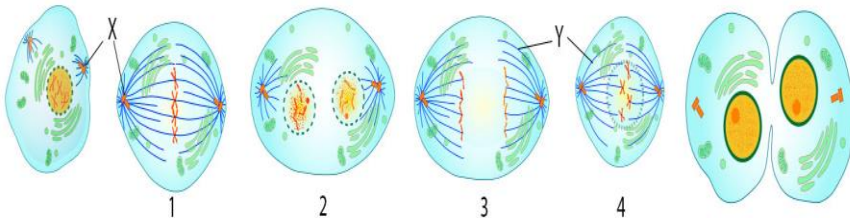
Name _____ Date _____

Mitosis

Match the phase to the correct description.

- A. Telophase
- B. Prophase
- C. Anaphase
- D. Metaphase

1. _____ Chromosomes attach to the spindle fibers and start to line up in the middle of the cell
2. _____ Two new nuclei start to form, and the chromosomes start to uncoil into chromatin
3. _____ Chromatin condenses into chromosomes as the cell prepares for division
4. _____ The chromatids are split and start to move away from each other to opposite ends of the cell



Use the diagram to put the phases of mitosis in order. The first picture is early prophase and the last is cytokinesis.

- _____ Prophase
- _____ Metaphase
- _____ Anaphase
- _____ Telophase

X represents _____

Y represents _____

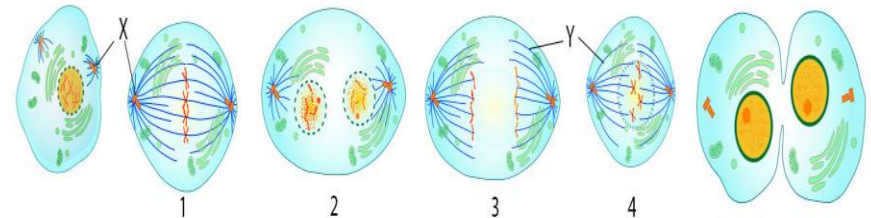
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- _____ Anaphase
- _____ Telophase

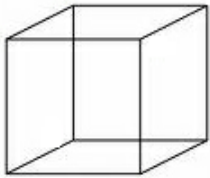
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Name _____ Date _____

Limits to Cell Size Bellringer

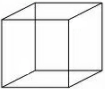
Calculate the surface area and volume for each cube (you may use your phone as a calculator).



Each side = 2 in

$$SA = L \times W \times 6 = \underline{\quad} \times \underline{\quad} \times 6 = \underline{\quad}$$

$$V = L \times W \times H = \underline{\quad} \times \underline{\quad} \times \underline{\quad} = \underline{\quad}$$



Each side = 1 in

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Calculate the surface area to volume ratio= surface area / volume

$$\text{Ratio 2 in cube} = \underline{\quad} / \underline{\quad} = \underline{\quad}$$

$$\text{1 in cube} = \underline{\quad} / \underline{\quad} = \underline{\quad}$$

$$\text{.5 in cube} = \underline{\quad} / \underline{\quad} = \underline{\quad}$$

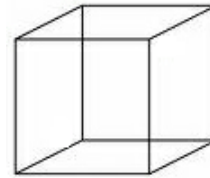
Which cell had the largest surface area to volume ratio?

Why would having more surface area compared to volume be beneficial to a cell? _____

Name _____ Date _____

Limits to Cell Size Bellringer

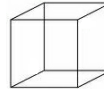
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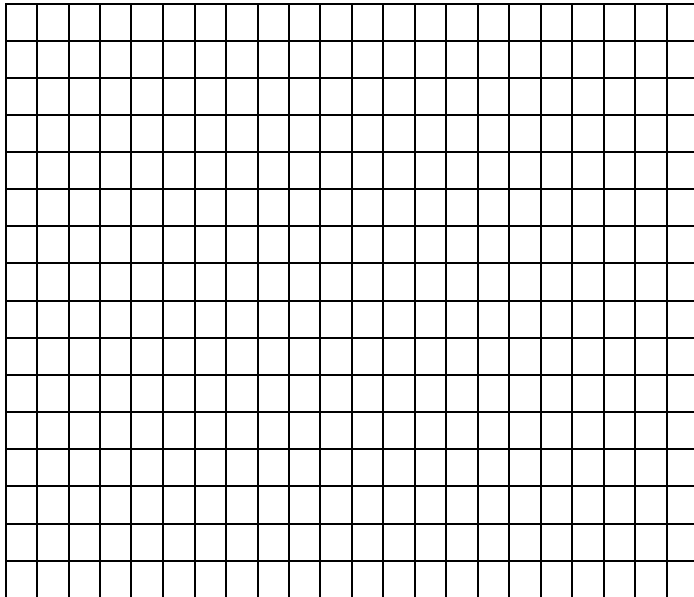
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Name _____ Date _____

Cancer Graphing: Create a bar graph using the data below. Be sure to include a title, labels on the axes, and an evenly spaced scale. Write a summary of the data in the space below.

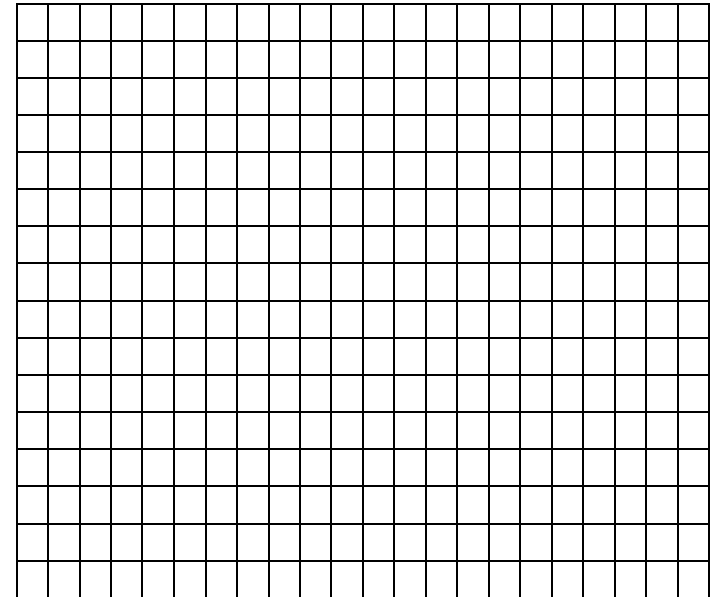
Top 10 Cancer Rates by Cancer Deaths in 2016	
Cancer Type	Rate per 100,000
Lung	38.5
Female Breast	20
Prostate	19.4
Colon/Rectum	13.7
Pancreas	11
Ovary	6.8
Liver	6.7
Leukemias	6.3
Lymphoma	5.4
Uterine	5



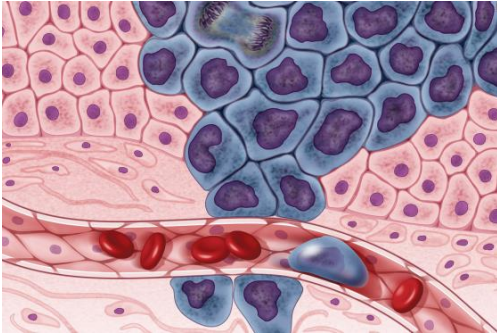
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Cancer Reading



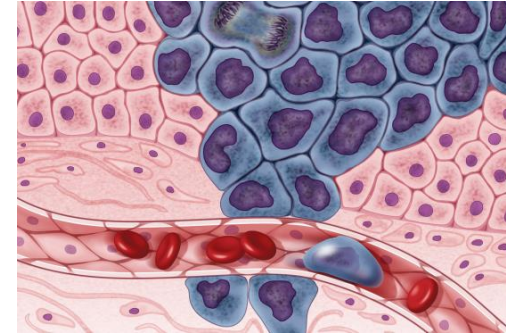
Cells do not live forever. They will eventually become damaged and need to be replaced. Some cells will last longer than others, but most will need to be replaced through mitosis at some point. Programmed cell death is known as **apoptosis** and will happen when cells are damaged beyond repair. Apoptosis and mitosis are both controlled through cell signals that are used to control cell activities. These signals help keep the cells functioning correctly in the body.

Sometimes cells are damaged by things like **carcinogens**, cancer causing substances, and they continue to divide uncontrollably. These cells ignore normal cell signals that would stop them from growing out of control and this results in cancer. Cancer cells do not have a limited life and will continue to divide as long as they have nutrients. In fact, HeLa cells were collected from a woman named Henrietta Lacks in 1951 and are still used in cancer research today.

Cancer cells do not function like normal cells. Their uncontrolled growth causes **tumors** that can invade the surrounding tissues and crowd out healthy cells. Cancer cells can also enter the bloodstream and travel to other parts of the body. Since cells ignore signals that would cause apoptosis, they can attach to other parts of the body and begin growing. **Metastasis** is when a secondary tumor starts in another area of the body.

Cancer is hard to treat because the cells aren't usually recognized as invaders and the immune system doesn't destroy them. Finding medicine that only targets cancer cells but doesn't damage healthy cells is a challenge that researchers are trying to overcome.

Cancer Reading



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Name _____ Date _____

Cancer

Use the reading to answer the questions.

1. How would apoptosis be useful in the body? _____

2. What are some carcinogens you've heard of? _____

3. Compare and contrast cancer cells and normal cells. _____

4. Explain metastasis. _____

5. What is one type of treatment for cancer? _____

6. Many cancer treatments focus on disrupting the division of cancer cells because they are growing out of control. What are some structures that could be destroyed and slow mitosis in the body, but not destroy all cells? _____

7. If treatments keep all cells from going through mitosis, this would include normal healthy cells. What are some side effects this would cause? _____

Name _____ Date _____

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Telomeres & Cancer

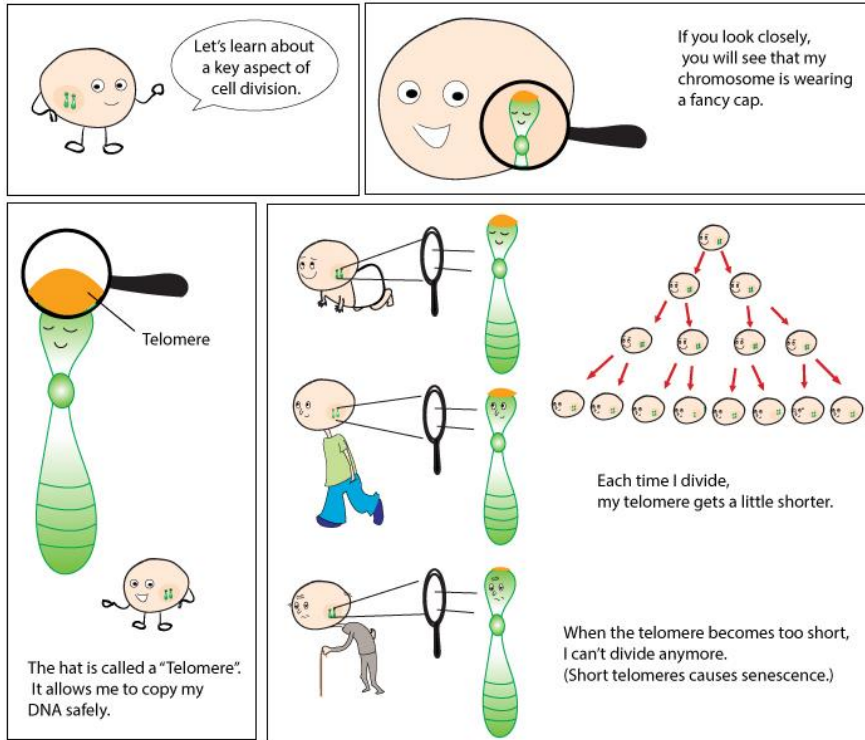


Figure 4: WassermanLab / CC BY-SA (<https://creativecommons.org/licenses/by-sa/4.0>)

The picture shows the relationship between mitosis and a section of the chromosome known as a telomere.

Cancer cells are considered to be immortal because they will never stop going through mitosis as long as they have nutrients. Normal cells will stop dividing when the telomere is too short. What do you think causes this difference between normal cells and cancer cells? _____

Name _____ Date _____

Telomeres & Cancer

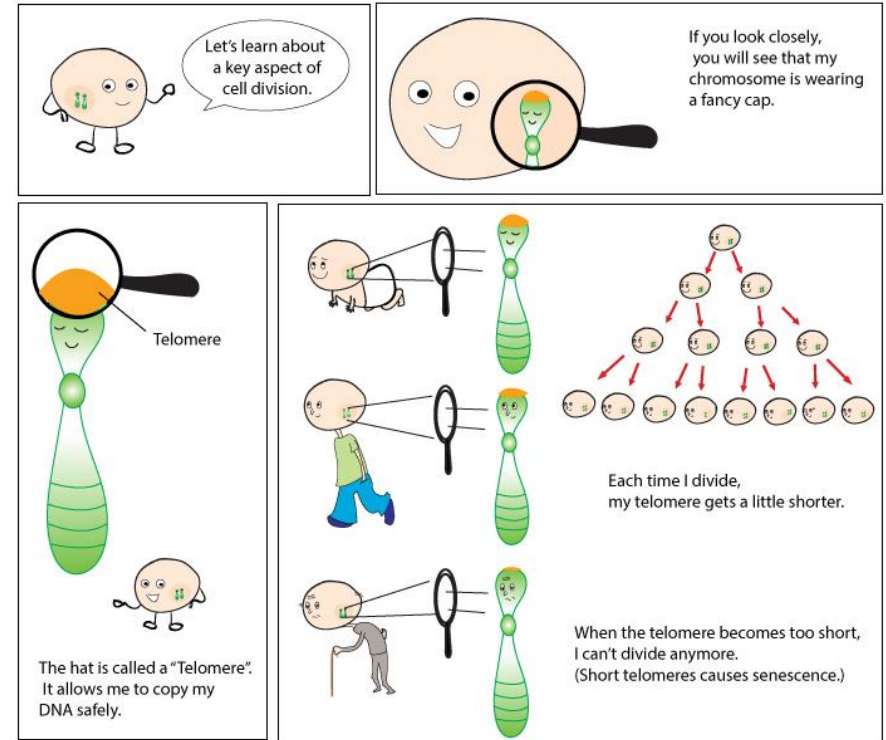


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